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Forest Research Notes

Northeastern Forest

FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 102 MOTORS AVENUE, UPPER DARBY, PA.

Experiment Station

No. 103
1960

EFFECT OF COMPETITION ON HEIGHT GROWTH AND SURVIVAL OF PLANTED JAPANESE LARCH

On the Dilldown Unit of the Delaware-Lehigh Experimental Forest in Pennsylvania, several planting studies have been made with the aim of finding the most economical and practical methods of converting scrub oak areas to productive high-forest types. These studies have already shown the need for site preparation prior to planting. Seedlings planted on prepared areas grew significantly faster than those in the untreated areas.¹

One of several methods of site preparation tried in these studies was by means of a rototiller--a machine that operates on the principle of a rapidly revolving cylinder armed with tines or knives. The tiller used in this study was a large, heavy model; it worked a strip 6 feet wide and was capable of chopping up the brush and mixing it into the surface 6 inches or so of soil. However, because of many stones in the soil of the experimental area, the machine could not be run at normal speed. Consequently, some of the heavier root crowns were not cut off and, in general, the roots were not as thoroughly macerated as would have been possible in stone-free soil.

In one phase of the rototiller tests, intensity of site preparation was varied by working the strips one, two, or three times. Subsequent observations of Japanese larch planted on these strips showed that survival and growth varied with intensity of treatment. The extent of the differences and their probable cause are discussed below.

¹ McNamara, E. F. and Reigner, I. C. Root competition slows growth of plantings on unprepared sites in scrub oak. Northeast. Forest Expt. Sta. Forest Res. Note 54. 3 pp. 1955.

Methods

Three plots, each about 800 feet long and comprising five strips, were prepared and planted in the spring of 1951. In one plot each of the five strips was tilled once; in a second plot they were tilled twice; and in a third plot, three times. One row of Japanese larch seedlings was planted in each strip. The seedlings were good-quality 2-0 stock ranging from 0.8 to 2.0 feet tall, and averaging about 1 foot.

Survival was checked annually, and after the third year heights were measured each year on an approximately 10-percent sample through the 1956 growing season. There are no data after 1956--the sixth year--because the planting was destroyed by a wildfire in May 1957.

Results

Rather unexpectedly, the site treatments affected seedling survival: the more intensive the treatment, the better the survival (table 1). The difference between the single and triple treatments was significant statistically, by conventional t-test, at the 1-percent level (after arcsin transformation of the percentage data). Differences between the single and double, and between the double and triple treatments, were significant at the 5-percent level.

Height growth also increased with intensity of treatment, as the following tabulation shows:

<u>Rototiller treatment</u>	<u>1953 height (feet)</u>	<u>1956 height (feet)</u>
Single	2.20	3.05
Double	2.50	3.60
Triple	2.69	3.90

For both of the years shown, differences between the single and triple treatments were significant at the 1-percent level, and those between the single and double treatments were significant at the 5-percent level. The double-treatment vs. triple-treatment differences were not significant.

Growth during the first 3-year period was faster than in the second 3 years of all treatments. Assuming a mean height of 1 foot at the time of planting, the 3-year growth figures are:

<u>Rototiller treatment</u>	<u>1951-53 growth (feet)</u>	<u>1954-56 growth (feet)</u>
Single	1.20	0.85
Double	1.50	1.10
Triple	1.69	1.21

Table 1.--Survival of planted Japanese larch seedlings
as affected by Rototiller treatments

Rototiller treatment	Survival at the end of--		
	2nd growing season	4th growing season	6th growing season
	Percent	Percent	Percent
Single	74	72	70
Double	81	80	78
Triple	89	86	85

Discussion

These are not good growth rates for Japanese larch, and the decline during the second 3 years is not a normal growth pattern. On the contrary, if the factors governing growth remain the same, growth rates normally increase after the second or third year. This is demonstrated by another planting of the same species at Dilldown, even though our data on it are not strictly comparable to those given above. In this planting, strips were cleared with a root-rake and have remained essentially free of competing vegetation. The seedlings averaged about 1.5 feet at planting, and 2.5 feet after 2 years. But during the next 3 years they put on more than 3 feet, reaching a mean height of 5.75 feet in the fifth year.

The cause of the comparatively poor growth in the rototiller planting is believed to have been the increasing competition--largely root competition, since very few trees were overtopped. The rototiller did not remove the vegetation as does a root rake or bulldozer--it merely set back this vegetation. Root crowns of many of the scrub or bear oak clumps remained wholly or partly in place, and resprouted vigorously. Of greater importance, probably, was the recovery by stoloniferous and root-suckering species such as blueberry, sheep laurel, chokeberry, bracken fern, and sassafras, which can regenerate from separate pieces of stolon or root. The less intensive the treatment, the quicker these species recovered, but by the end of the third year they had practically regained their former density, even on the triple-tilled strips.

Japanese larch is noted for its inability to withstand competition. In view of this species characteristic, the generally poor growth of the trees in this planting over the 6-year period, the somewhat better growth under the more

intensive site treatments, and particularly the decline in growth as the native vegetation recovered, all support the theory that competition was the chief inhibiting factor. If the planting had not burned out, it is possible that the trees, after slowly gaining some additional root and crown development, would have overcome the depressive effects of the competition and grown at a satisfactory rate. In this particular case we shall never know. However, on the basis of the evidence at hand, it does not seem advisable to plant Japanese larch in scrub oak areas without some sort of site preparation that completely removes all vegetation in the vicinity of each seedling. For this purpose, clearing strips by means of a bulldozer or root-rake is recommended.

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